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ABSTRACT

A great deal has been written in the educational literature about the use of distance education, given the rapid expansion of the World Wide Web on the Internet. Web-based courses are now available or under development at many academic institutions and through corporate universities. Educators are concerned, however, about ensuring the quality of online courses, and many question whether online courses can maintain the same high standards of excellence as traditional classroom instruction. One way to ensure quality control over online instruction is to establish an ongoing instructional quality assessment process. This chapter discusses background information and several considerations for assessing the quality of online instruction. (Contains 47 references.) (GCP)

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Assessing the Quality of Online Instruction: Integrating Instructional Quality and Web Usability Assessments

By
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Chapter 49
Assessing the Quality of Online Instruction
Integrating Instructional Quality and Web Usability Assessments

Anthony Ciavarelli

A great deal has been written in the educational literature about the use of distance education, given the rapid expansion of the World Wide Web on the Internet. Educators and trainers are enthusiastic about the potential for reaching learners across a medium that allows "anywhere and anytime" teaching. Web-based courses are now available or under development at many academic institutions and through corporate universities. Such online courses allow individuals to complete needed educational or training programs from their desktop computers at a convenient time and place. Online courses are especially desirable for learners who are unable to attend traditional classes on campus because of their remote geographic location or their limited time availability.

Educators are concerned, however, about ensuring the quality of online courses, and many question whether online courses can maintain the same high standards of excellence as traditional classroom instruction. One way to ensure quality control over online instruction is to establish an ongoing instructional quality assessment process. In this chapter I discuss background information and several considerations for assessing the quality of online instruction.

Questions Educators Ask About Online Instruction

Administrators, educators, and students question several key issues of online instructional quality, and some question the feasibility of attaining critical learning objectives outside the traditional classroom and laboratory. Among commonly asked questions are the following:

- Can complex learning objectives associated with problem solving and critical thinking skills be taught online?

- How does one address the issues of socialization and collaboration in learning among students using online instructional formats?
- What makes an online course successful or unsuccessful?
- How can we ensure acceptable quality of online instruction?
- How can we demonstrate that students receiving online instruction have equitable standards, attention, and resources compared to on-campus students?
- What kinds of data should be collected to measure the quality and the effectiveness of online education?

In this chapter I discuss the background and foundation of a proposed conceptual framework for assessing the quality of online instruction. This e-Learning Assessment Framework is presented in the chapter appendix. In this framework, I consider factors related to human learning and motivation, instructional quality standards, best web teaching practices, and web page design and usability guidelines. My premise is that the quality of web-based instruction is a result of all these factors.

The development of high-quality web learning environments requires careful planning and a systematic development process. The development process needs to take into account what we know about human learning capabilities and human motivation to learn. High-quality online instruction also depends on careful application of established principles of instructional design, use of the best web design practices, good human engineering, and adequate provisions for institutional support. The background and formation of this assessment framework is discussed below.

Instructional Design Issues

Instructional design encompasses several issues, including pedagogy, development of instructional systems, theories of human learning, and how web-based instruction must differ from traditional instruction. All these topics are covered in this section.

Pedagogy

The growth of online instruction has raised new interest and much discussion about *pedagogy,* or how best to teach. The term actually comes from Greek roots, *paid* and *agogos,* and in translation means "the art of teaching children." The primary audience for much of our

existing online instruction, however, is adults seeking education in a venue that will allow them to continue their employment while working on educational goals part time. Adults have different needs than children. As Knowles (1980) so aptly points out, children have little experience, are able to focus on academics, are subject centered, and are easily motivated by external rewards. Adults, on the other hand, have greater experience levels, tend to be focused on acquiring job skills, are more problem centered, and are self-motivated to learn. A good teacher knows that individual learners have different levels of experience, capabilities, and motivation levels, and takes such factors into consideration in his or her approach to teaching.

I have encountered people involved with online instruction who use *pedagogy* in place of a particular technology or course-delivery method. They might say, for example, that the use of online instructional formats, such as online discussion forums or chat rooms, represent a new pedagogy. In my view, pedagogy refers, or should refer, to the art of effective teaching, not to a specific technology or content-delivery method. Whenever we plan to teach, on the web or in the classroom, we should first address the pedagogical issues of how best to teach our subject to the expected audience. Some questions that every teacher should ask when developing a course are these:

- Who am I trying to teach?
- What content do I need to teach?
- How can I best organize this content?
- What is the best presentation strategy and lesson sequence?
- What is the best way to deliver the content?
- How will I know when I have succeeded in teaching what I intended to teach?

Professional instructional designers typically ask themselves these or similar questions when they apply a systems approach, sometimes referred to as the instructional systems development (ISD) process to course development.

Instructional Systems Development

ISD is a process model that defines steps or tasks that course developers need to complete to ensure that they pay adequate attention to critical components of instruction. The ADDIE model—named after the five critical process steps or phases of analysis, design, development, implementation, and evaluation—is thoroughly described by Hodell (2000) and will not be discussed in any detail here.

The importance of the ADDIE model to assessment is twofold. First, the model has enjoyed considerable success in the training community as a means to standardize instruction and impose quality standards. An ADDIE approach has helped to improve some of the more poorly planned and haphazard training interventions. In traditional classroom education, there has been little acceptance and application of this kind of systematic approach. In contrast, the application of ISD methods to online instruction is receiving much attention, probably because efforts to convert classroom content to web delivery require careful planning, design, and development in order to achieve a seamless integration of course content and teaching strategies with course-delivery technologies.

The ISD model and some activities typically engaged in at each of the development phases are briefly summarized here (based on Hodell, 2000, pp. 12–13):

Analysis. Activities include assessment of student learning needs, data gathering regarding subject matter or content, and organizational and technology implementation issues.

Design. The focus is on specification of learning objectives and performance standards, defining subject matter content, defining the curriculum, designing lesson plans and tests, selecting media, and addressing resource and support needs.

Development. This stage involves production of instructional materials and student and teacher guides, courseware authoring, and software development, according to specifications in the design.

Implementation. Implementation addresses delivery, management, and control of the education and learning process.

Evaluation. Continuous measurement and evaluation of the instructional products and processes takes place in all phases of ISD.

One goal of applying the ADDIE model is to ensure that all critical components of instruction, such as inclusion of learning objectives, appropriate teaching strategies, and relevant assessment methods, are present in any resulting course or curriculum. Most educators know that the mere application of a theory or process cannot guarantee high-quality instruction will result. Educators' opinions vary, however, as to

what teachers must do to ensure that learning takes place as intended. Some of the differences in opinion about learning may trace their roots to varying views about human learning. Ultimately, the student who experiences the result of such a process will be the best person to judge the quality of instruction. The perception of quality will be determined by the learner's own goals and expectations and his or her unique experiences taking the course.

Views About Human Learning

There are many views of human learning, but perhaps the most common and relevant are behavioral, cognitive, and constructive learning theories. I briefly compare and contrast each of these viewpoints here.

Behavioral Learning Theory

This approach to teaching humans actually evolved from studies of animal behavior in the psychology laboratory. Early behaviorists (e.g., John Watson, Edward Thorndike, and B. F. Skinner) studied only learning that could be easily observed and measured. As a result their learning approaches tended to focus on tasks and skills that could be objectively defined and taught through hands-on practice with feedback on performance results. Techniques such as defining behaviors to be taught; arranging situations so that the behaviors could be attempted; and providing reinforcement, or feedback about performance, are still used today in many training environments. Such an approach may work well in an application such as training equipment operators to memorize and practice specific operating procedures. But a purely behavioral training method is difficult to apply to teaching complex human problem solving and critical thinking skills (Ford, 2000).

Bell (1985, pp. 36–40) nicely summarized a behavioral approach to education and training:

1. Define learning objectives as measurable outcomes.
2. Define the learning prerequisites or entry skill level.
3. Present instruction in a progressive sequence of least to most difficult.
4. Make connections between current and previous instruction.
5. Present examples, sample problems, and guidance for problem solving.
6. Teach basics, give a variety of examples, give practice with feedback, and test performance at the end of instruction.

7. Provide immediate feedback on results.
8. Provide information about how to correct errors (remedial instruction).
9. Redirect the student's instruction based upon diagnosis of performance problems.

Cognitive Learning Theory

Cognitive theorists recognize that people are different from animals in their thinking abilities, and they are capable of guiding their own learning processes based upon abilities, or cognitive structures, that they establish through a lifetime of learning. Furthermore, cognitive psychologists maintain that humans are both extrinsically and intrinsically motivated to learn. They do not depend solely upon external events to control their learning and motivation to learn. Thus, cognitive learning theorists suggest that educators take advantage of these thinking processes, self-organizing learning strategies, and intrinsic motivation to learn (Ford, 2000; Johnson & Thomas, 1994).

Merrill and his associates developed a theory of instruction based upon cognitive science principles (Merrill, 1983; Merrill, Reigeluth, & Faust, 1979) . This approach to instruction is sometimes called a *prescriptive approach to instruction,* or *prescriptive instructional theory,* because the strategies for delivering and assessing instruction are based upon specific learning objectives and their associated performance requirements. The prescriptive approach to instruction follows a defined process to ensure that certain critical components for producing high-quality instruction are present. The basic components of Merrill's prescriptive instructional design theory, sometimes referred to as *component display theory* or *component design theory* (CDT), are as follows (Ciavarelli, 1988, p. 13):

1. Analyze and classify the task or activities the learner is to perform (as specified in learning objectives).
2. Select the most appropriate teaching strategy based upon the type of learning and subject matter content.
3. Evaluate instructional quality based upon the adequacy and consistency of the key components of instruction across learning objectives, teaching strategies, and assessment methods.

The CDT approach actually borrows heavily from behavioral methods in that it incorporates a systematic process of writing learning objectives as learning outcomes. The instructional presentations are

highly structured based upon the particular classification of learning objectives and instructional content. Certain elements of cognitive psychology are added, however, to accommodate concept learning and problem-solving tasks; for example, learning strategies that support the learning encoding process. These cognitive learning strategies include such things as the use of mnemonics, mental rehearsal, and subject matter organizers, highlighting, and isolation of core learning materials to draw the learner's attention to key information. Another fundamental tenet of this approach is to allow some means for the learner to control the learning process.

For example, in some forms of computer-based instruction, learner control is achieved by incorporating learner-selected options or choices (Merrill, 1980). The learner is allowed to select the desired level of difficulty and also can access additional instructional support and help. The instruction typically includes a broad range of subject matter explanations, illustrations, and examples that are helpful in teaching specific concepts and principles. For example, when CDT is used to design a concept lesson, the instructional sequence might go something like this (Ciavarelli, 1988, p. 14):

1. Define the concept and highlight or isolate the key attributes that characterize or typify it.
2. Provide examples and instances that represent the concept. Include both examples and nonexamples (examples that do not represent the concept).
3. Allow the learner to apply the definition of the concept and to list the attributes needed to classify various instances or examples of concept classes.
4. Assess learning by having the student classify new instances or examples as examples or nonexamples of the concept.

Merrill (1994) refined his CDT to provide a broader focus on course structuring and to accommodate the use of expert systems technology (artificial intelligence) in providing advisory tutoring to students taking computer-based or online courses. Using such "expert tutor" technology, the best advice of a teacher can be incorporated into the instruction to guide and advise the student along different learning paths, and to help correct errors and possible misconceptions.

Constructive Learning Theory

Constructive learning theory suggests that students do not just passively receive education; they actively engage in organizing and

making sense of the information they receive. In essence, they construct their own knowledge base by integrating new information and experiences with pre-existing (already learned) information. According to constructive learning theorists, learning is best achieved by setting a context in which students can readily understand where new knowledge fits into their own experience and how such knowledge can be used in a real-world setting. The teaching focus is on establishing a learning environment in which the learner is involved in actively constructing knowledge from the ongoing learning experience and in connecting new knowledge to previous experiences (Kerka, 1997).

Teachers play an important role in the learning process by arranging instruction that encourages students to engage in active learning situations and participate in problem-solving activities, sometimes working alone and other times working in groups. The teacher helps to organize problem-centered activities, then guides and encourages inquiry and exploration of possible solutions. Instructional materials, problem-solving situations, and assessments are often set in practical contexts that invite students' interest because the learning experience is directly applicable to real-world environments. This aspect of constructive learning theory is sometimes referred to as *situated learning*, in which knowledge is formed and made more meaningful by establishing an authentic learning situation. (Kerka, 1997).

The most effective learning, then, takes place when learners attempt to understand and make sense of the learning experience and begin to fit their new knowledge into their own unique experience base or conceptual framework. From the constructivist point of view, the most effective learning takes place when teachers allow students to work with engaging, problem-centered instructional materials; when they provide guidance along the way as needed; and when they encourage collaboration among learners.

People learn in social contexts by observing others and by actively participating in conversation and functions with others (Bandura, 1977). The acquisition of language and culture plays a large role in learning higher cognitive skills and in building motivation and strategies for learning how to learn (Vygotsky, 1978).

Bruner (1990), who coined the term *discovery learning*, believes that human learning is inextricably embedded in an individual's culture. Humans learn because they want to make sense of their world and understand its workings. Knowledge about the world, then, is a social construction composed of the information that learners have acquired

within a cultural or social framework.

An obvious advantage of web instruction is that one can reach students at a distance, anytime and anywhere. From a constructivist standpoint McManus (2001) points out that another key advantage is that the web represents a vast source of information resources that can be used in an instructional program. Teachers can, in the course of teaching on the web, connect their students with noteworthy institutions of learning, libraries, and museum websites to provide motivation and enhance the educational experience.

The availability of vast web resources invites a constructivist approach to teaching. Spiro, Feltovich, Jacobson, and Coulson (1991) suggest that higher-order learning is not taught very effectively with a behavioral objective approach in which the educator specifies learning outcomes and controls the learning process. From the constructivist view, it should be the learner who sets the learning goals and directs the knowledge acquisition process. Spiro and associates believe that multiple interconnections among knowledge components should be emphasized. In addition, the web provides for a high level of interconnections among knowledge sources (McManus, 2001). The teaching strategy is based upon providing guidance to the student by arranging student-directed web-learning activities that include the use of web resources, and by facilitating collaboration among students via Internet communication modes, such as e-mail and discussion forums or chat rooms.

Web instruction lends itself to constructive forms of instruction through planning engaging learning activities and through planning collaborative learning projects (using communication features). Encouraging collaborative learning and intercommunication among students helps to build a learning community and to offset feelings of isolation that students who take technology-based educational programs may experience. Sandra Kerka (1996) suggests a number of ways to improve online instruction:

> (1) Understand the technologies' strengths and weaknesses; (2) provide technical training and orientation; (3) plan for technical failures and ensure access to technical support; (4) foster learning to learn, self-directed learning, and critical reflection skills; (5) develop information management skills to assist learners in selection and critical assessment options; (6) structure learner-centered activities for both independent and group work that foster interaction. (p. 3)

Constructivism and Authentic Assessment

The constructivist movement places great emphasis on putting the learner in control of the educational process. Going hand in hand with this shift in focus is the movement toward authentic assessment, in which teachers examine students' performance on meaningful intellectual tasks (Wiggins, 1990). Wiggins (1990, p. 1) raises the following key points:

- Traditional classroom exams do not transfer well to the real world, making them poor substitutes for measuring student performance in relation to realistic settings.
- Authentic tests attempt to develop engaging student tasks that simulate realistic tasks such as conducting research, collaborating with other students on a research paper or project, or reporting on current social events or scientific breakthroughs.
- Authentic tests are representative of ill-structured problem domains and are thought better to prepare a student for professional practice and transfer of education to real-life situations.

Authentic testing is often associated with the development of assessment rubrics. A *rubric* is an assessment tool that corresponds as closely as possible to a real-world problem or situation (Moskal, 2000). This form of assessment is considered much more appropriate to enhancing the learning experience than traditional, objectively scored classroom exams.

Recent Ideas in Instructional Design

Sonwalker (2001a) argues that web instruction, with some of its new multimedia enhancements (video, animation, and simulation), requires a new pedagogy. He describes four applicable learning styles: *incidental* (event-driven reactive learning), *inductive* (the introduction of instances or examples of a concept to exemplify a principle being taught), *deductive* (presentation of simulations or graphic or mathematical representations that illustrate trends and drive learners to draw conclusions), and *discovery* (learning within the knowledge domain via self-directed inquiry). Sonwalker suggests multiple modes of presentation to allow for different and wide-ranging learning pathways. A very clever three-dimensional pedagogical learning cube is proposed as a teaching strategy model or conceptual framework.

The cube, similar in appearance to a Rubik's Cube puzzle, depicts an instructional system comprising the teacher, student, learning style, and media type. The model can be used to "organize and sequence multimedia content assets in a pedagogically distinctive learning path that matches the style of the individual learner" (Sonwalker, 2001b, p. 12).

Web Page Design and Usability Guidelines

The part of a computer system (including the Internet and various websites) that the user sees and communicates with is called the *user interface*. The user interface provides the means for the user to interact with the computer. Anyone who has attempted and failed to program a videocassette recorder correctly, or who has accidentally deleted or lost a computer file, knows the frustration of interfaces that are poorly designed for the typical user. Web-based instruction is embedded in a computer system that, if not carefully designed, may result in the same kinds of operational difficulties and consequent user frustration.

Over the years, human factors engineers specializing in human-computer interaction (HCI) and usability engineering have attempted to influence the design of computing systems to make them easier to use. HCI is a discipline concerned with the design, evaluation, and implementation of interactive computing systems. By applying HCI design principles, developers of computer systems have learned to design systems more carefully to ensure that computers are easier to use and less error prone. HCI concerns itself with involving the user in the design process, applying design guidelines to simplify system operation, and providing the user with assistance when needed. An HCI designer works mainly to improve user interface designs. One important part of the human factors method is to conduct usability testing throughout development. Usability refers to a measure of the quality of the user's experience when interacting with the system such as a personal computer, videocassette recorder, or website (Stefanyshyn, 2001). Usability testing is conducted to test the ease of learning and simplicity of operation of the interface by having a sample of intended users try out the system. Usability engineers may observe users operating the system and take note of difficulties, or they may conduct surveys and interviews to obtain data regarding the ease of operation. Based on such information, the usability engineer may redesign the human interface to make it easier to use (Jordan, 1998). One does not have to be an engineer to consider human factors in web page designs for online

instruction, however. Some key design questions regarding the human interface are these (Jones, 1989, p. 13):

- How should the function of the system be described and presented to the user?
- How can the design of the user interface help the user to understand and use the system?

  Where am I?
  What can I do here?
  How did I get here?
  Where can I go, and how do I get there?

I would add one more question for the user who becomes totally lost in the system: How do I get out of this mess? The goal of HCI and usability engineering is to design a system that is easy to operate, intuitive, and quickly learned. The following guidelines are used in meeting such design objectives (Jones, 1989, pp. 21–45):

- Maintain consistency in display format, information layout, and position.
- Use landmarks and signposts to show user his or her present (web page) location, the path traversed, and what lies ahead.
- Indicate the present condition or state of the system through operating messages such as "downloading now," "please wait," "estimated time to complete," and the like.
- Indicate the start and completion of each task.
- Give user a way out of a mess. For example, give the user a way to go to the home page and start over.

In summary, the user interface is designed to maintain consistency in information formats and location of content on a web page. The most usable systems pay attention to the target users' needs and abilities. Functional operation and navigation choices are compatible with users' experiences with other similar systems, and the system provides feedback to the user, such as acknowledging inputs, advising the user of processing wait periods, and providing navigational assistance, error alerts, and corresponding recovery methods. The specific application of these principles, and other key design issues and usability methods in creating user-friendly web pages, are covered extensively in Jakob Nielsen's popular book *Designing Web Usability* (2000). The book also contains many examples of good and bad web pages to illustrate design principles.

Institutional Support Issues

Online courses, as I have mentioned, must be carefully planned, designed, and executed. Agencies that govern academic accreditation or set quality standards have considered establishing criteria regarding institutional responsibilities and requirements in online instruction. I have incorporated some of the criteria being considered by the Western Association of Schools and Colleges (WASC) and the National Education Association (NEA) in the e-Learning Assessment Framework in the appendix. By way of summary, an institution planning to offer online courses has to consider where online course offerings fit into its academic mission, as well as to plan for adequate resources and facilities to provide the needed technology, faculty development, and student services support infrastructure. Academic institutions that have a successful campus program and are planning to undertake new programs of distance learning would be wise to follow the example of the British Open University, one of the more prominent and successful distance learning institutions in the world. The ingredients of success for the Open University, as reviewed by Sir John Daniel (2001), are quite revealing: "The Open University is lucky in that it does not have to be satisfied with the assumption of quality. Britain now has a ferocious quality assessment system that sends groups of peers, under state supervision, to judge the quality of teaching of each discipline in each university, against six criteria: (1) curriculum design, content, and organization, (2) teaching, learning, and assessment, (3) student progression and achievement, (4) student support and guidance, (5) learning resources, and (6) quality assurance and enhancement" (p. 3). The current high standing of the British Open University is a consequence of applying these criteria. The quality of its distance learning program is maintained because close attention is given to producing excellent course materials, maintaining close personal academic support for the students, establishing effective logistics (having the right materials at the right place at the right time), and encouraging active faculty research.

Using the e-Learning Assessment Framework

Education and training are all about learning, teaching, and ultimately learner performance as defined by the goals of the institution, the objectives of the course, and the special interests of the student. Assessment should provide an objective and valid means to judge one's

educational and training accomplishments as an educator and administrator of learning. Assessment should provide important diagnostic feedback to the student to improve learning, to the teacher to improve the instructional process, and to the institution to improve its curriculum, support services, and infrastructure.

I am in the process of developing an online assessment system, using a web-based questionnaire survey methodology. The e-Learning Assessment Framework in the appendix provides a useful point of departure for specifying measurement dimensions and for constructing survey items. Selecting from the appendix, for example, one might construct a simple checklist to identify important criteria for designing or assessing online courses, as shown in the following examples, one a checklist approach and the other a Likert-scale approach.

Checklist Approach (From Designer's Perspective)

[ ] Course learning objectives are clearly stated.
[ ] The instructor's role is defined.
[ ] Interactivity is consistent with the learning objectives or intent.
[ ] Student collaboration is encouraged when appropriate.

Likert-Scale Approach (From Student's Perspective)

The role of the instructor was clearly defined:
___ strongly disagree ___ disagree ___ neutral
___ agree ___ strongly agree
The course content often included active learning tasks:
___ strongly disagree ___ disagree ___ neutral
___ agree ___ strongly agree

In this manner, a course designer or an instructor can use items in the e-Learning Assessment Framework to build an assessment tool that meets his or her particular interests and requirements. The e-Learning Framework simply provides some assurance that the many dimensions of instructional assessment are considered in the evaluation construction process. The framework incorporates behavioral, cognitive, and constructivist views. It is up to the developer of an assessment instrument to decide on the selections most appropriate to the purpose of the evaluation. Another important point in developing an assessment instrument is to evaluate all components of an instructional system, including the quality and value of the instructional content, the instructor's performance, the instructional strategy used, the presentation method (lecture, seminar, learning activity), the delivery system, the appropriateness and reliability of the technology and media, and the

institutional support services.

Appendix A: e-Learning Assessment Framework

Instructional Quality Measure	Suggested Readings
A. Instructional Quality	
1. Learning objectives are consistent with the stated purpose of the course.	Bell, 1985
2. Learning objectives are clearly stated in terms of performance expected and conditions required (behavior, conditions, standard).	Johnson & Thomas, 1994
3. Instruction is adequate to meet specified objectives, including	Kerka, 1997
a. Content completeness and relevance	Knowles, 1980
b.Content organization and information sequencing and structure	Merrill n.d.
c. Balance among general facts, concepts, principles, and process steps in applying intended knowledge and skills	Merrill, 1994
d. Inclusion of relevant examples, illustrations, and practice exercises	Merrill, Reigeluth, & Faust, 1979
4. Exam content is based on learning objectives.	Montague, Willis, & Faust, 1980
5. Exam performance requirements are consistent with the learning objectives.	
6. Exam items are well constructed (easy to interpret and not ambiguous).	
7. Instructions for taking exams are clear, and responses expected on exams are well defined.	
8. Learning strategies are selected to enhance learning.	
9. Instructional content is presented in the most effective and efficient way, based upon learning strategies selected.	
10. Instructional presentations adequately prepare students to perform as specified in learning objectives.	
11. Students are given an opportunity to practice and review (with feedback and remedial work if needed) prior to taking an exam.	
12. Instruction includes learning activities with authentic and engaging instructional materials and (if applicable) work that requires student interaction and collaboration.	
13. Students are given clear instructions and mechanisms for obtaining learning assistance and help from the instructor in understanding course requirements.	

Appendix B. Web Instruction Best Practices

1. The role of the instructor is well defined. 2. The means of access to the instructor are clearly indicated. 3. Communication methods (e-mail, bulletin board or forum, chat room) are identified. 4. Online help with communication methods is available to students. 5. Multiple varieties of interaction are incorporated (student learning material, student-student interactions, and student-teacher interactions). 6. Media used are appropriate for learning objectives (i.e., media add value to instruction). 7. Student collaboration is encouraged when appropriate. 8. Content engages students in active learning tasks. 9. Internet links are meaningfully related to learning objectives. 10. Internet links are appropriately placed so as not to interrupt the logical flow of instruction. 11. Group activities are used to promote learning. 12. Group activities are used to promote socialization and development of a learning community. 13. Course structure capitalizes on the availability of resources on the Internet. 14. Course structure capitalizes on the communication capabilities of the Internet by encouraging peer collaboration and contact with subject matter experts. 15. Students are provided with a convenient means to interact with faculty and with other students taking the course or instructional program. 16. Students are informed online about how to obtain help with coursework, exams, and assignments 17. Online assessment methods are relevant and fair tests of achievement, based upon learning objectives and course performance expectations. 18. Assessment methods emphasize authenticity in that performance is evaluated using practical (real-world) problem-solving tasks. 19. Feedback on exams and assignments is constructive and timely.	Boettcher & Conrad, 1999 Kerka, 1996 McManus, 2001 Palloff, 1999 Sonwalker, 2001b

Appendix C. Web Design and Usability Guidelines

1. Students are given instructions and guidance on necessary website navigation for the course. 2. Web page navigation links are meaningfully labeled. 3. Information is logically organized into related sets or chunks. 4. Information sets or chunks are logically located on display screen. 5. Information sets or chunks appear consistently in expected display locations. 6. Consistency is maintained in information formats, content layout, and content location on the screen. 7. Logical layout and spacing are used to control display density. 8. Minimum font size is 9 points (10–12 points recommended). 9. Upper- and lower-case letters are used for text. 10. Font size is varied only for emphasis. 11. Use of blue and red colors for text is avoided. 12. Web pages start and end on a coherent topic. 13. Page change function, rather than scroll, is used at the end of a logical segment. 14. Landmarks and signposts are used to show the user his or her present location in instructional sequence or website geography, path traversed, and what lies ahead. 15. A visual sign is used to identify current operating mode, and initial changes in mode are indicated by auditory tone, if multimode functions are accessed. (Applies mainly to simulations and animated demonstrations.) 16. A visual sign or selectable auditory signal, or both, are used to indicate the start and end of a task. 17. The user is given a clearly indicated option to escape from a specific mode, operating condition, unwanted website or page. For example, an option to page back or return to a home page position is always available and clearly indicated. 18. Accommodations are made in display and auditory presentations for students with modest visual and hearing impairments (e.g., selectable font size and text-audio redundancy).	Jones, 1989 Jordan, 1988 Nielsen, 2000 Shneiderman, 1998

Appendix D. Institutional and Support Infrastructure

1. The student is informed about the technology required for taking a course or instructional program.	Daniel, 2001
2. The student is informed about the technical competency required to take a course or a specific instructional program.	National Education Association, 2000
3. The student is informed about the institutional requirements, including cost of course or program, course duration, time allowed for completion, any prerequisites or special skills required, and support services available.	WASC, 2000
4. Instructional materials are kept current through timely updates.	
5. Available student services are clearly defined and accessible.	
6. The technology delivery system is adequate to support courses offered and student loads.	
7. The technology delivery system is as reliable and fail-safe as possible.	
8. The student is informed about how to obtain help with technology issues.	
9. The student is provided with necessary library and informational resources to meet course objectives.	
10. Convenient access is provided for students to obtain assistance with administrative and technology problems.	

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